REMARKS/ARGUMENTS

Status of Claims

Claims 8, 9, 11-14, 16, 17, 23-28, 30-36, 38-41, and 43-58 are being resubmitted. Claims 8, 23, 24, 33, 41, 43, and 55 have been amended. Claims 1-7, 10, 15, 18-22, 29, 37, and 42 have been canceled without prejudice or disclaimer of the subject matter. No new Claims have been added.

Claims 8, 9, 11-13, 24-26, 30-36, 38, 39, 43, 52, and 53 were rejected under 35 U.S.C. 103(a) as being unpatentable over Bereskin (U.S. Patent No. 4,159,499). The Office Action further rejected Claims 14 and 15 under 35 U.S.C. 103(a) as being unpatentable over Bereskin (U.S. Patent No. 4,159,499) in view of Sid (U.S. Patent No. 6,359,761). The Office Action still further rejected Claim 27 under 35 U.S.C. 103(a) as being unpatentable over Bereskin (U.S. Patent No. 4, 159,499) in view of Finlay, Sr. et al. (U.S. Patent No. 6,980,005). The Office Action still further rejected Claim 28 under 35 U.S.C. 103(a) as being unpatentable over Bereskin (U.S. Patent No. 4,159,499) in view of Tobin (U.S. Patent No. 6,727,682). The Office Action still further rejected Claims 23, 41, 44, 46, 55, 57, 58, and 16 under 35 U.S.C. 103(a) as being unpatentable over Bereskin (U.S. Patent No. 4,159,499) in view of Taniguchi et al. (U.S. Patent No. 5,000,692). The Office Action still further rejected Claim 40 under 35 U.S.C. 103(a) as being unpatentable over Bereskin (U.S. Patent No. 4,159,499) in view of Loh (U.S. Patent No. 3,801,871). The Office Action still further rejected Claim 45 under 35 U.S.C. 103(a) as being unpatentable over Bereskin (U.S. Patent No. 4,159,499) in view of E.L. Harder (U.S. Patent No. 2,809,330). The Office Action still further rejected Claims 47 and 48 under 35 U.S.C. 103(a) as being unpatentable over Bereskin (U.S. Patent No. 4,159,499) in view of Engel et al. (U.S. Patent No. 5,963,405). The Office Action still further

rejected Claim 49 under 35 U.S.C. 103(a) as being unpatentable over Bereskin (U.S. Patent No. 4,159,499) in view of O.C. Traver (U.S. Patent No. 1,919,969). The Office Action still further rejected Claims 51, 54, and 56 under 35 U.S.C. 103(a) as being unpatentable over Bereskin (U.S. Patent No. 4,159,499) in view of Taniguchi et al. (U.S. Patent No. 5,000,692) and Blades (U.S. Patent No. 5,434,509).

Support for the amendments can be found, for example, in the detailed description in paragraphs [0038], [0040], [0051], and [0052], and in Figures 1, 3 and 4. A line fault is defined as a "line-to-line fault" in paragraph [0052], and a ground fault is defined as a "line-to-ground fault" in paragraph [0051]. One unit of "multiple windings" is shown in Figure 1 (element number 134) as being wound on the magnetic core 132 (see also paragraph [0038]. The three-phase system 122 is shown in Figure 1 and described in paragraph [0040] as consisting of only three electrical sources (260, 262, and 264, Figure 1).

Examiner Interview

A telephonic interview was conducted between the Examiner and Applicant's representative. Proposed amendments to the claims were discussed. Further discussed were the references Bereskin (US 4,159,499) and Taniguchi et al. (US 5,000,692).

The Examiner indicated that the proposed amendments would distinguish the present invention over the cited prior art and that the rejection would be overcome. No further agreement was reached.

Section 103(a) Rejections

<u>Bereskin (US 4,159,499)</u>

Bereskin teaches a circuit for detecting line-to-ground and neutral-to-ground faults and in response thereto interrupting the line conductor. Included in the circuit is a magnetic core 36 about which the neutral conductor 22 and the line conductors 20, 20a, and 20 b (Figure 1) are wound to produce a zero net magnetomotive force in the magnetic core 36 in absence of a line fault and a non-zero net magnetomotive force in the presence of a line fault. A secondary winding 38 wound on the magnetic core 36 has a load 40 connected there across. The load 40 has a dynamic impedance, which is reflected back to the neutral winding. Also included are a constant currency high frequency oscillator 41 and a voltage sensor 42 connected across the neutral winding 22 to detect decreases in the neutral winding resistance due to a line fault and/or decreases in the high frequency current through the neutral winding due to a neutral fault. An electromechanical actuator responsive to the voltage monitor 42 trips a circuit breaker to interrupt the line conductors 20, 20a, and 20b when a neutral or line-fault is detected (abstract; Figure 1; Col. 2, lines 56-69; and Col. 3, lines 1-47).

The present invention, as in Claims 8, 23, 24, 33, 41, 43, and 55 (as amended) teaches a line-to-ground and line-to-line fault interrupter (illustrated, for example in Figure 1) that uses a magnetic core 132 through which the three load wires of a three-phase system that powers an electrical load extend. Only one unit of multiple conductive windings 134 is arranged on the magnetic core 132 such that the current flow through the load wires can be monitored and imbalances in the current flow can be detected. The load current 266, 268, and 270 flowing through the load wires creates a magnetic field that induces a current onto the windings 134 (as in Figure 1). The magnetic core 132 and the only one windings 134 of the present invention, as in Claims 8, 23, 24, 33, 41,

43, and 55 (as amended), are arranged such the core/windings set can not only detect the current flow through the load wires but can be used to determine imbalances between the three load wires, which allows for detection of line-to-line faults and line-to-ground faults. Furthermore, the present invention, as in Claims 8, 23, 24, 33, 41, 43, and 55 (as amended), utilizes two sensing circuits 140 and 142 to monitor the one unit of conductive windings 134 and detect imbalances in the current flow. If a current imbalance increases beyond a preset threshold, the sensing circuits will provide a fault current to a circuit breaker detector 138, which is a printed wiring board circuit breaker (shown in Figure 1), that trips the circuit breaker detector 138 (as in new Claim 43 and in Claim 8, as amended). Using a printed wiring board circuit breaker as shown in Figure 1 of the present invention, as in Claims 8, 23, 24, 33, 41, 43, and 55 (as amended), has the advantage that the circuit breaker may be tripped on very low current draw. Typically, circuit breaker included in circuit breaker systems for electrical circuits, such as the circuit breaker system 121 shown in Figure 1 of the present invention, are designed to handle potentially very large current loads. To prevent having very large components on the ground and line fault interrupter adapter (as in Figures 3 and 4 and Claims 23 and 55) to open the load lines directly, the small printed wiring board circuit breaker is used to provide a trip signal to the existing circuit breaker system 121 (as in Figure 1 and Claims 8 and 43, as amended).

The present invention (as in Claims 8, 23, 24, 33, 41, 43, and 55, as amended) provides detection of line-to-ground faults (ground faults) and line-to-line faults (line faults) (as in paragraphs [0041], [0051], and [0052]), while Bereskin provides detection of line-to-ground (line faults) and neutral-to-ground faults (neutral faults) (abstract, first sentence; Col 1, lines 8-9; Col. 3, lines 32 and 34). Contrary to Bereskin who teaches "line conductors" (20, 20a, and 20b Figure 1) and a "neutral conductor" (22 Figure 1) (Col. 3, lines 2-4), the present

invention claims only tree load wires or electrical sources (as in Claims 8, 33, and 43, as amended, as in paragraph [0040], and as in Figure 1), no "neutral conductor" is used in the present invention. Since Bereskin connects a constant currency high frequency oscillator 41 and a voltage sensor 42 across the neutral winding 22 to detect line-to-neutral and/or line-to-ground faults it would not have been obvious to connect the two sensing circuits to the only one multiple conductive winding 134 (Figure 1), which is comparable with the secondary winding 38 (Figure 1) of Bereskin, to detect line-to-line and/or line-to-ground faults as done in the present invention (as in Claims 8, 23, 24, 33, 41, 43, and 55, as amended).

Furthermore, Bereskin teaches winding the line conductors (20. 20a, and 20b Figure 1) and the neutral conductor (22 Figure 1) on the magnetic core (Col. 3, lines 23-28), whereas the present invention feeds the load wires directly through the magnetic core (as in Claims 8, 23, 24, 33, 41, 43, and 55, as amended, and as shown in Figure 1). Contrary to Bereskin, in the present invention (as in Claims 8, 23, 24, 33, 41, 43, and 55, as amended) the load wires are not wound on the magnetic core. In the present invention (as in Claims 8, 23, 24, 33, 41, 43, and 55, as amended, and as shown in Figure 1) no more than one unit of multiple conductive windings 134 (Figure 1) is wound on the magnetic core. The one unit of multiple conductive windings 134 of the present invention is comparable with the secondary winding 38 of Bereskin (Col. 3, lines 14-15, Figure 1).

Still further, Bereskin monitors current and/or volt changes in the neutral conductor to detect line-to-ground faults and neutral-to-ground faults (Col. 3, lines 39-47), whereas the present invention (as in Claims 8, 23, 24, 33, 41, 43, and 55, as amended) does not include a neutral conductor. Contrary to Bereskin, the present invention (as in Claims 8, 23, 24, 33, 41, 43, and 55, as

amended, and as shown in Figure 1) utilizes no more than one unit of multiple conductive windings 134 to provide a first output voltage directly proportional to a line-to-ground fault level and a second output voltage directly proportional to a line-to-line fault level that are monitored and evaluated by two separate sensing circuits.

Therefore, Bereskin does not make obvious the present invention as in Claims 8, 23, 24, 33, 41, 43, and 55, as amended. Consequently, the section 103(a) rejections should be withdrawn.

Sid (U.S. Patent No. 6,359,761)

Sid teaches a secondary ground fault protection for a high voltage power supply that utilizes a high voltage transformer with a center tapped secondary coil. Sensing circuitry connected with the secondary coil includes sub-circuits to generate various outputs, which indicate the presence of faults. The outputs of the sub-circuits can be combined using a logical OR gate (280, as in Figure 4) to cause specific actions in response to each detected fault (abstract). Thus, if the output of any one of the fault sensing comparator 75, defective sensing transformer circuit 250 or floating ground detection circuit 260 is a digital high, the latching circuit 230 and power switch circuit will be activated, thereby shutting down the power supply until it is reset (Figure 4; Col. 5, lines 16-25).

The present invention, as in Claims 14 and 50, utilizes an OR gate to combine the outputs of the two sensing circuits and to connect them to the input of a printed wiring board circuit breaker similar to the Or gate used by Sid. Since Bereskin utilizes only one sensing circuit, it would not have been obvious to combine the OR gate of Sid with the circuitry of Bereskin, since there is no need to combine two outputs. Furthermore, even if Bereskin would have used

the OR gate of Sid, the present invention (as in Claims 8, 23, 24, 33, 41, 43, and 55, as amended) would not have been obvious since Bereskin teaches a neutral conductor, which is not utilized in the present invention, and Bereskin monitors current and volt changes in the neutral conductor to detect line-to-ground and line-to neutral faults while the present invention utilizes a secondary winding (multiple conductive windings 134, Figure 1), which provides a first output voltage directly proportional to a line-to-ground fault and a second output voltage directly proportional to a line-to-line fault.

Therefore, Sid does not make obvious the present invention, as in Claims 8, 14, 43, and 50 (as amended), either alone or in combination with the other references of record. Consequently, the section 103(a) rejections should be withdrawn.

<u>Finlay, Sr. et al. (U.S. Patent No. 6,980,005)</u>

Finlay, Sr. et al. teach an electrical wiring protection device for use in coupling an AC power distribution system to at least one electrical load. The device includes an automated self-test circuit coupled to the AC power distribution system. The automated self-test circuit is configured to generate at least one simulated fault signal during a first predetermined half-cycle of AC power (abstract). A by-pass circuit is activated when the differential current exceeds a predetermined amount (Col. 11, lines 34-41). By-pass circuit 1126 is configured to actuate SCR 24 when the fault current exceeds 100 mA (Figure 1, Col. 13, lines 10-15).

Since Bereskin teaches monitoring a neutral conductor for line-to-ground and line-to-neutral fault conditions, while the present invention as in Claims 24, 33, and 41, as amended, teaches detecting a magnetic field using a magnetic

core and only one secondary winding (multiple conductive winding) and converting a fault current fed through the magnetic core into a line-to-line or line-to ground fault signal, the method of Bereskin is different from the method of the present invention (as in Claims 24, 33, and 41, as amended). Therefore, it would not have been obvious to apply the preset value of the fault current of Finlay, Sr. et al. to the fault detection method of Bereskin.

Therefore, Finlay, Sr. et al. do not make obvious the present invention, as in Claims 24, 33, and 41 (as amended), either alone or in combination with the other references of record. Consequently, the section 103(a) rejections should be withdrawn.

Tobin (U.S. Patent No. 6,727,682)

Tobin teaches an apparatus for remotely sensing the currents flowing in a set of substantially parallel conductors carrying a plurality of independent AC currents. The apparatus includes a plurality of magnetic field sensors positioned to take mutually independent measurements of the magnetic field generated by the conductors and provide corresponding signals. An instrument 110 (Figures 7-10) contains four magnetic field sensors and is mounted below an AC overhead power line having four substantially parallel wires R, Y, B and N whose currents are to be measured (Col. 7, lines 29-39). The instrument 110 is preferably rated to measure 0-1000 amps as a balanced current in all three wires of an overhead line or as a fault current in any one wire with return through the earth, and may have two or more user selectable ranges, e.g. 0-500 and 0-1000 amps (Col. 10, lines 15-20).

Since Bereskin teaches monitoring a neutral conductor for line-to-ground and line-to-neutral fault conditions, while the present invention as in Claims 24,

33, and 41, as amended, teaches detecting a magnetic field using a magnetic core and only one secondary winding (multiple conductive winding) and converting a fault current fed through the magnetic core into a line-to-line or line-to ground fault signal, the method of Bereskin is different from the method of the present invention (as in Claims 24, 33, and 41, as amended). Therefore, it would not have been obvious to apply the fault current data of Tobin to fault detection method of Bereskin to obtain the present invention as in Claim 24 (as amended) and as in Claim 28.

Therefore, Tobin does not make obvious the present invention, as in Claim 24 (as amended) and as in Claim 28, either alone or in combination with the other references of record. Consequently, the section 103(a) rejections should be withdrawn.

<u>Taniguchi et al. (US 5,000,692)</u>

Taniguchi et al. teach an interface module for mounting relays to be connected with a central controller and individual external I/O devices, while the present invention (as in Claims 23, 41 and 55, as amended) provides an adapter module that can be mounted between an existing electric circuit module that may include relays or circuit breaker and a socket to add line-to-line and line-to-ground fault protection to existing electrical wiring systems (paragraphs [0055] -[0059]).

The present invention as in Claims 23, 41, and 55 (as amended) teaches an adapter module 156 that includes the ground and line fault circuitry as in Claims 8, 24, 33, 41, and 43, as amended and as in Figure 1. The ground and line fault interrupter adapter module 156, as shown in Figure 3 of the present invention and as claimed in Claims 23, 41, and 55 (as amended), can be

inserted in-between an existing socket 152 that is in electrical communication with an external electrical system and an electrical circuit module 158, which includes a relay module or a circuit breaker system 121. The adapter module 156 provides ground and line fault interrupter function without any modification to the existing wiring of an electrical system. The ground and line fault interrupter adapter module 156 of the present invention (as in Claims 23, 41, and 55, as amended) can be used with existing relay systems and with existing circuit breaker systems since it provides an electronic fault signal to either system once a detected fault current exceeds a preset threshold, which causes either the relay system or the circuit breaker system to open the load lines.

In Figures 6 and 7 (Col. 6, lines 33-45), Taniguchi et al. show a relay 30A separately mounted on an individual terminal block 100, which is connected with the interface module 10 via a cable 102. As can be seen a cable is used to provide the electrical connection and not an adapter, as used in the present invention (as in Claims 23, 41, and 55, as amended). Furthermore, in Figure 1 (Col. 5, lines 7-25), Taniguchi et al. show the interface module 10 as a housing 40 that includes sockets 50, where each socket 50 receives a relay 30. The interface module also includes wire terminals for connection with individual I/O devices via wires, a connector port 70 for connection with the central controller 20 via a flat or ribbon cable 71, and an expansion connector for connection with an expansion relay interface module via an expansion cable. As can be seen, contrary to the present invention no adapters are used between the relay and the socket, as would be the adapter of the present invention (as in Claims 23, 41, and 55, as amended).

Therefore, Taniguchi et al. do not make obvious the present invention, as in Claims 8, 23, 24, 33, 41, 43, and 55 (as amended), either alone or in combination with the other references of record. Consequently, the section

103(a) rejections should be withdrawn.

Loh (U.S. Patent No. 3,801,871)

Loh teaches a ground fault current interrupter circuit for detecting a ground fault on a hot conductor and on a grounded neutral conductor of a power line. A phase comparator in the phase locked loop of the ground fault current interrupter circuit compares the phases of the oscillator signal and the signal in the tuned circuit and produces in response thereto a frequency tracking signal which is coupled back to the voltage control oscillator to change its frequency to coincide with the changed resonant frequency of the tuned circuit. In this manner it is virtually assured that only a resistive fault to ground exceeding a predetermined magnitude will initiate operation of the GFI circuit (Col. 2, lines 20-25).

Since Loh only teaches the detection of line-to-ground faults and Bereskin only teaches line-to-ground and line-to-neutral faults, were as the present invention, as in Claim 33 (as amended) and as in Claim 40, enables the detection of line-to-ground as well as line-to-line fault conditions, the present invention as in Claim 33 (as amended) and as in Claim 40 could not have been obtained even if the circuit of Bereskin would have been equipped with the voltage control oscillator of Loh to change the frequency.

Therefore, Loh does not make obvious the present invention, as in Claim 33 (as amended) and as in Claim 40, either alone or in combination with the other references of record. Consequently, the section 103(a) rejections should be withdrawn.

Harder (U.S. Patent No. 2,809,330)

Harder provides power line fault protection and teaches equipment that achieves fault discrimination at a low energy level. The equipment is disposed within a circuit breaker and uses line-derived power for tripping and for supplying the elements of the equipment (abstract; Col. 1, lines 29-45; Col. 9, lines 57-62).

Even though Harder teaches equipment that performs line-to-ground fault discriminating functions at an energy level, which is much lower than the energy level, which is typically needed for conventional tripping mechanisms, it would not have been obvious to combine the teachings of Harder with the teachings of Bereskin to obtain the ground an line fault interrupter as in Claims 43 (as amended) and as in Claim 45, since neither Harder nor Bereskin teach or suggest the use of a printed wiring board circuit as a circuit breaker detector as does Claim 45 of the present invention. Furthermore, both Harder and Bereskin teach detection of line-to-ground faults, while the present invention as in Claims 43 (as amended) and Claim 45 teaches the detection of line-to-ground faults as well as the detection of line-to-line faults. Neither Harder nor Bereskin teach or suggest the detection of line-to line faults.

Therefore, Harder does not make obvious the present invention, as in Claims 43 (as amended) and as in Claim 45, either alone or in combination with the other references of record. Consequently, the section 103(a) rejections should be withdrawn.

<u>Engel et al. (U.S. Patent No. 5,963,405)</u>

Engel et al. teach a low cost analog arcing detector and a circuit breaker. Incorporating such a detector provides a variable response time to arcing faults

based upon the amplitude of the arcing current. A filter generates pulses having an amplitude proportional to the amplitude of the step increase in current generated by the striking of the arc. The pulses are rectified and the amount by which the single polarity pulses exceed a threshold value, selected to eliminate nuisance trips on current step increases characteristic of some common loads, is integrated by a capacitor connected to a resistor, which continually adjusts the capacitor voltage in a sense opposite to that of the pulses. The capacitor and resistor are selected to generate a trip signal (abstract).

While Engel et al. teach a filter and a rectifier as does the present invention as in Claim 43 (as amended) and as in Claims 47 and 48 Engel et al. generate pulses that are proportional to the current increase generated by a striking arch whereas the present invention (as in Claim 43 (as amended) and as in Claims 47 and 48) includes an impedance that provides a voltage drop that is rectified and filtered. Since neither Bereskin not Engel et al. teach the detection of line-to-line faults as does the present invention (as in Claim 43 (as amended) and as in Claims 47 and 48), the ground and line fault interrupter of the present invention (as in Claims 43 (as amended) and as in Claims 47 and 48) could not have been obtained even if the filter of Bereskin (included in the voltage sensor) would have been selected to eliminate nuisance trips as is the filter of Engel et al.

Therefore, Engel et al. do not make obvious the present invention, as in Claim 43 (as amended) and as in Claims 47 and 48, either alone or in combination with the other references of record. Consequently, the section 103(a) rejections should be withdrawn.

<u>Traver (U.S. Patent No. 1,919,969)</u>

Traver teaches a protective apparatus providing selective action on a time basis dependent on the distance between the fault and the apparatus. A flux dependent on the differences between the currents inn two conductors is produced in sets of double windings. On occurrence of a short circuit between the two conductors a flux appears that is proportional to the sum of the fault currents in the two conductors since the two conductors are displaced 180 degree (page 4, lines 117-123).

Contrary to Traver who teaches building the sum of fault currents registered with a plurality of sets of double windings (Figure 2; 48-48', 54-54', 63-63') each wound on a different magnetic core, the present invention as in Claim 43 (as amended) and as in Claim 49 includes no more than one unit of multiple conductive windings (134, Figure 1) and a current induced onto this winding is summed together to provide a first and a second output voltage proportional to a line-to-ground fault or a line-to-line fault, respectively. Since Traver utilizes more than one winding and more than one magnetic core and since Bereskin utilized one magnetic core having all load wires and a neutral wire wound on it would not have been obvious to combine the teachings of Traver and Bereskin to obtain the ground and line fault interrupter of the present invention as in Claim 43 (as amended) and as in dependent Claim 49 where a magnetic core is claimed that has no more than one unit of multiple conductive windings wound on.

Therefore, Traver does not make obvious the present invention, as in Claim 43 (as amended) and as in Claim 49, either alone or in combination with the other references of record. Consequently, the section 103(a) rejections should be withdrawn.

Blades (U.S. Patent No. 5,434,509)

Blades teaches an arc detector for detecting potentially hazardous arcing in electrical connections. The arc detector includes detection and signal processing circuitry for monitoring high-frequency noise characteristic of arcing on the power line and distinguishable from other sources of high-frequency noise (abstract). The arc detector includes test and reset circuits that enable manual actuation of the circuit breaker and resetting the circuit breaker (Col. 25, lines 31-37).

Even though Blades teaches a test circuit and a reset circuit similar to the present invention (Claims 43 and 55 (as amended) and as in Claims 51, 54 and 56), the present invention (Claims 43 and 55 (as amended) and as in Claims 51, 54 and 56) could not have been obtained by equipping the ground fault detection and protection circuit of Bereskin or the I/O relay interface module of Taniguchi et al. with the test and reset circuits of Blades, since neither Bereskin nor Taniguchi et al. teach a ground and line fault interrupter that enables the detection of line-to-ground faults as well as line-to line faults.

Therefore, Blades does not make obvious the present invention, as in Claims 43 and 55 (as amended) and as in Claims 51, 54 and 56, either alone or in combination with the other references of record. Consequently, the section 103(a) rejections should be withdrawn.

CONCLUSION

Applicants would like to thank the Examiner for the telephone interview of April 10, 2006. In such interview, the Examiner reviewed the above amendments to Claims 8, 23, 24, 33, 41, 43, and 55 and approved the same as overcoming the rejections in the March 23, 2006 Final Office Action.

Reconsideration and withdrawal of the Office Action with respect to Claims 8, 9, 11-14, 16, 17, 23-28, 30-36, 38-41, and 43-58 will be respectfully requested. It is believed that Claims 8, 9, 11-14, 16, 17, 23-28, 30-36, 38-41, and 43-58 are now in condition for allowance. Applicants will respectfully request that a timely Notice of Allowance be issued in this case.

In the event the examiner wishes to discuss any aspect of this response, please contact the attorney at the telephone number identified below.

☒ The Commissioner is hereby authorized to charge payment of the following fees with this communication or credit any overpayment to Deposit Account No. 50-0851:

☒ Any filing fees under 37 CFR 1.16 for the presentation of extra claims.

Respectfully submitted,

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